

NERRS Science Collaborative Progress Report for the Period September 1, 2012 through February 28, 2013

Our Coast—Our Future: Planning for Sea Level Rise and Storm Hazards in the San Francisco Bay Area

Principal Investigators: Patrick Barnard, Grant Ballard, Kelley Higgason, Marina Psaros

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Report compiled by: Kelley Higgason

Contributing team members and their role in the project: Patrick Barnard (applied science PI), Grant Ballard (applied science PI), Megan Elrod (outreach support), Michael Fitzgibbon (lead engineer), Kelley Higgason (project coordinator), Sherie Michaile (informatics engineer), Doug Moody, (informatics engineer), Marina Psaros (collaboration lead), Sam Veloz (spatial ecologist), Julian Wood (collaboration liaison)

A. Progress overview: State the overall goal of your project, and briefly summarize in one or two paragraphs, what you planned to accomplish during this period and your progress on tasks for this reporting period. This overview will be made public for all reports, including confidential submissions.

The ultimate goal of the Our Coast—Our Future (OCOF) project is to provide the tools and information needed for local decision-makers to develop climate change adaptation strategies, and take actions to ensure healthy, viable, and sustainable coastal ecosystems and communities. We plan to accomplish this goal by producing a science-based, online decision-support tool to help local decision makers plan for and respond to sea level rise and storm hazards along the San Francisco Bay shoreline. The support tool will be built in collaboration with end users. A fine scale resolution (2 meter) Digital Elevation Model for San Francisco Bay, and localized extreme storm and sea level rise scenarios will be developed to underlie the tool. This project builds on a related effort already underway on the North-central California outer coast (referred to hereafter as “Outer Coast”), and the resulting tool will be available for the shoreline of the entire 9-county San Francisco Bay Area.

During this reporting period, the team has: launched a new project website; managed a focus group for the Outer Coast portion of the tool; assembled and held two meetings with the project Advisory Committee; continued to synthesize and process feedback received from stakeholders; launched the Outer Coast portion of the tool at the 3rd Biennial Ocean Climate Summit; presented the project at several professional conferences and meetings; and interfaced with expert peers.

B. Working with Intended Users:

Describe the progress on tasks related to the integration of intended users into the project for this reporting period.

During this reporting period, the team held several formal and informal information exchanges with the OCOF Advisory Committee (our main vehicle for intended user collaboration) as a group and individually. During the January 16, 2013 Advisory Committee meeting, the OCOF team members lead a discussion about the various barriers to the adaptive process. The goal was to hear from the users what

hindered or might hinder their progress at any stage of the adaptive process (defining the problem, planning, assessing and selecting adaptation actions, and implementing, managing and evaluating the outcome of the selected option). Another goal of the discussion was to identify what could be done to overcome each barrier, who might be involved in the solution and when it might happen. In addition, the team members sought to clarify which of the barriers the project is best suited to address through the tool or the collaborative process. The discussion began by reviewing a list of barriers already identified by other potential users and by the Advisory Committee itself during previous meetings. The barriers discussed included real and perceived barriers and were not limited to only ones the tool could address. All the barriers and potential solutions brought up at the meeting were recorded on-screen onto a spreadsheet, which will be a valuable resource to the team members as the tool is constructed.

The final Outer Coast Focus Group meeting was also held in December. Attendees were stationed at individual computers and asked to apply predetermined use cases to the North-central coast sea level rise and storms mapping tool, as well as evaluate the overall project website. Based on feedback solicited from this meeting, the project team updated and revised the tool in preparation for its February 2013 launch.

What did you learn? Have there been any unanticipated challenges or opportunities?

These exchanges have increased our understanding of inherent barriers to tool adoption, as well as opportunities. One example of a tool adoption barrier is obsolescence: our tool will be the “state of the art” for approximately 3-5 years, after which time scenarios may need to be updated to reflect changes in land use (such as levee structures), environmental conditions, and availability of data and information sources that do not yet exist or that may change over time. Projects that we originally thought might be ideal candidates for technical assistance may need to be reconsidered, and we have also identified new opportunities for partnership and application of the tool.

Several impediments plaguing users were centered on a lack of understanding about how to conduct scenario-based planning using the tool (i.e., which sea level rise curve to choose and how to interpret model results). These issues highlighted the need for the OCOF In-depth Technical Assistance Program, which will help users understand how to interpret and use the tool for planning.

Another common barrier encountered by users was the difficulty in working or collaborating across jurisdictions or organizations. The Committee members cited examples of difficulties when working with local governments or the private sector. The team heard Committee members say, “we don’t speak the same language” more than once. The team learned that the OCOF project could be a part of the solution by presenting and communicating economic data to bridge communication gaps among organizations and jurisdictions and that OCOF should consider folding in the Association of Bay Area Government’s (ABAG) disaster planning as a way to engage local governments.

We also learned that the OCOF project is already playing an important role by providing space for our Intended Users to share ideas for solutions. For example, it was noted that the Local Coastal Program (LCP) process could help local jurisdictions with planning process. There were many examples throughout the meeting of users filling in each other’s information gaps.

Who has been involved?

The entire team has been involved in various outreach and integration activities.

Has interaction with intended users brought about any changes to your methods for integration of intended users, the intended users involved, or your project objectives?

We designed a collaborative process that requires input at several key points in the project in order to move forward. During this reporting period, we have not encountered any unanticipated “changes” to our methods or objectives as a result of our interactions with intended users, but we have reached several collaborative decision points, which help to ensure that we build a product that our intended users find useful.

One example of these collaborative decision points is “nested grids”. The OCOF Advisory Committee has been asked to help identify and select areas around the San Francisco Bay where “nested grids” (areas of higher resolution data) will be incorporated into the OCOF tool. Whereas most of the Bay model will make explicit predictions every 100m, in areas with nested grids, predictions are made every ~10 meters. We will be able to include approximately 8 nested grids, each approximately 4 x 4 kilometers. During our last Advisory Committee meeting, we discussed how nested grids were relevant to the project and the planning processes of committee members, and developed selection criteria for choosing sites. Between meetings, we are researching Advisory Committee nominations in order to make a joint decision at our next meeting in April. This is one example of how intended user input shapes our product.

Based on the last user feedback session, where we had the outer coast focus group use the tool to solve real problems, we discovered many user interface issues we had to address in making the presentation of information clearer and easier to understand. We ended up removing some data layers because they either didn’t provide the information people needed or were simply too confusing to explain in a tool like this. Feedback about these changes thus far appears very positive.

How do you anticipate working with intended users in the next six months?

In the next six months, we will continue to work with our Advisory Committee on decisions related to model scenarios and DST functionality. We will also develop a framework for the technical assistance program to help managers incorporate the tool into their planning processes. As the release of the outer coast tool was later than originally anticipated when the NERRSSC funding was granted, the technical assistance program has not yet been initiated, but will be over the next six months.

C. Progress on project objectives for this reporting period:

Describe progress on tasks related to project objectives for this reporting period.

Project Team meetings, management: Proceeded as planned. Team meetings were held on October 1st and 10th, 2012 and January 22, 2013.

October 1, 2012 – Modeling, tool development (outer coast), and stakeholder engagement (including the agenda for the October Advisory Committee meeting) discussed. Webinar capability was provided through PRBO.

October 10, 2012 – Review of outer coast tool User Interface stakeholder engagement (including December Outer Coast Focus Group Meeting agenda and use cases, and October Advisory Committee meeting presentations) discussed. Webinar capability was provided through PRBO.

January 22, 2013 – Modeling, roll out plan for outer coast tool launch, tool video tutorials, and stakeholder engagement (including preliminary planning for tool training webinars and the OCOF Technical Assistance Program, and debriefing on the January Advisory Committee meeting) discussed. Webinar capability was provided through PRBO.

Hold San Francisco Bay Advisory Committee meetings: Proceeded as planned. The initial meeting was held on October 19, 2012 and our second meeting was held on January 23, 2013. See above for meeting details. Feedback about the content and format of meetings has so far been very positive.

Launch North-central California coast decision support tools: Proceed as planned. The public beta launch of the OCOF decision support tools for sea level rise and storms for the North-central California coast, from Bodega Head to Half Moon Bay, was held as part of the 3rd Biennial Ocean Climate Summit in San Francisco. Over 140 attendees were presented background information on the project and viewed a live demo of the website, tutorials, forum, and mapping tool capabilities.

Coordinate with relevant national, state and local efforts: Proceed as planned. Staff met with NOAA Sea Level Rise Viewer staff to discuss outreach, barriers to use, terms of use for the data, and technology infrastructure choices to learn lessons from their efforts. Co-authored a FEMA Coastal Beat newsletter article on the similarities and differences between OCOF and FEMA's California Coastal Analysis and Mapping Project (<http://www.r9map.org/Pages/EbulletinStory.aspx?storyID=14>).

What data did you collect?

We continued to aggregate infrastructure and ecosystem data layers for the outer coast tool. The USGS Earth Resources Observation and Science (EROS) Data Center completed a draft of the Digital Elevation Model (DEM) for the entire San Francisco Bay area using all recently collected multibeam bathymetry and topographic LiDAR. The DEM is now being reviewed by experts at NOAA and undergoing final QA/QC using a series of recently acquired coastal structure and levee data sets, before it will be released publicly next month. The DEM for the outer coast was completed during the prior reporting period and published (<http://pubs.usgs.gov/ds/684/>). Roland Burgmann at UC Berkeley completed analyzing twenty years of IfSAR data to assess recent rates of vertical land movement, which will enable us to modify the DEM for future scenarios as appropriate. A draft report with results has been submitted to PI Barnard for review and comment. We have completed future wave modeling projections for the Pacific Ocean using forcing from Global Climate Models developed for CMIP5 (IPCC5). The results of this work will be used to drive ocean swell into San Francisco Bay in our model runs. We have been strategizing the use of fluvial data, wind data, wave data, SLR-based tidal amplification, and vertical land motion to making our vulnerability assessment more robust.

Has your progress in this period brought about any changes to your methods, the integration of intended users, the intended users involved or the project objectives?

The issue of tidal amplification induced by SLR and a fixed shoreline, highlighted by recent work at UC Berkeley by Holleman and Stacey, has prompted us to consider some sensitivity testing of future scenarios with and without a hardened shoreline.

Have there been any unanticipated challenges, opportunities, or lessons learned?

While not necessarily unanticipated, there are challenges and opportunities presented by the rapidly evolving technology available for use on this project. We are engaged with an ever-growing set of application developers and more examples of decision support tools are made available regularly, so we

strike a balance between looking for great examples of things similar to what we are building and making progress internally.

In discussions with climate scientists in the region, including those involved in climate model downscaling, primarily within the USGS CaSCADE2 project (e.g., Noah Knowles, Dan Cayan, Mike Dettinger, etc.), we recognized the importance of including downscaled winds in San Francisco Bay to refine our in-Bay wave development and wave-induced flooding. However, they have also advised us to consider historical synoptic wind measurements, as they are not convinced that GCM-downscaled winds are sufficient to properly represent the orographic effects in the Bay Area.

The physical processes that drive sea level rise and surge are different in San Francisco Bay versus the outer coast. Our plan is to provide a single user interface to explore these two areas; however, the data may be different between the two. We still want that single user experience, but will have to work with our advisory committee to see how to display different information in a way that makes sense to the user.

What are your plans for meeting project objectives for the next six months?

The following objectives are scheduled to take place during the next 6 months:

Project Team meetings, management: Monthly team meetings will be held with webinar capability.

Hold San Francisco Bay Advisory Committee meetings: Upcoming meetings are scheduled for April 18th and July 11th, 2013. We will continue to use the format of previous meetings: a presentation on an aspect of the OCOF project for which we are seeking input or a decision (see above example regarding nested grids), followed by interactive discussion. Meetings close with an update from a committee member on that organizations' sea level rise-related work.

In depth technical assistance, feedback, and evaluation for outer coast tools: Two training webinars on the use of the tools will be held in March and April. Over the next 6 months we will also begin soliciting interested users that desire in depth technical assistance in applying the tool to their project, and develop the technical assistance program based on current planning processes.

Develop flexible framework for web-based DST; revise as needed: Over the next six months we will solicit feedback from our outer coast focus group, as well as through the Community Forum provided with the mapping tool, to improve the map interface, community of practice, and overall usability of the beta decision support tool as needed.

Predict physical climate change impacts from scenarios: We will continue to interact with our colleagues in the region to develop the best approach for integrating the completed vertical land motion rates in our DEM, downscaled wind and pressure fields, and fluvial discharge rates. Based on our Advisory meetings, we are close to finalizing our high-resolution model sites, which, when completed, will allow us to begin production of the model grids, begin running sensitivity tests, and ultimately scenarios.

Assess effects of scenarios on infrastructure and ecosystems; develop/revise web-based DST: We will use GIS and the full set of aggregated layers as identified by stakeholders to assess impacts of scenarios and begin to incorporate visualizations of impact risk/vulnerability into the DST.

- D. Benefit to NERRS and NOAA: List any project-related products, accomplishments, or discoveries that may be of interest to scientists or managers working on similar issues, your peers in the NERRS, or to NOAA. These may include, but are not limited to, workshops, trainings, or webinars; expert speakers; new publications; and new partnerships or key findings related to collaboration or applied science.**

During this report period, several team members served as expert speakers at a variety of conferences and meetings. Psaros and Barnard participated in a workshop panel in Southern California called “Beyond Bathtub” which sought to clarify different SLR modeling and tool approaches. The workshop brought together approximately 100 Southern California coastal managers. Fitzgibbon, Psaros, and Higgason provided a demo of the preliminary outer coast tools at the “Symposium of Sea Level Rise in California” in San Francisco. Fitzgibbon, Psaros, and Higgason provided a project presentation and preliminary tool demo to local, state, and federal agencies with jurisdiction in Marin County. Fitzgibbon and Higgason provided background on the project and launched the outer coast tools at the Ocean Climate Summit in San Francisco.

The OCOF project has also provided two opportunities for “transfer” within the NERR system. The first transfer project stems from our users’ interest in accessing climate change visualization data on mobile devices, and has resulted in a needs assessment / product plan that describes mobile opportunities for the NERR System, using Padilla Bay NERR as a case study. The second project is transferring stakeholder analysis knowledge and products to the Tijuana River NERR as they launch a climate change vulnerability assessment for the Tijuana River Valley. This second transfer project also enabled a half-day summit of several climate change adaptation practitioners who are involved in the “human dimension” and social science aspects of adaptation planning.

- E. Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know.**

These have been adequately addressed in other sections of the report.